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A REVIEW OF THE INTRODUCED LYGAEIDAE OF THE PACIFIC NORTHWEST, INCLUDING THE NEWLY DISCOVERED *PLINTHISUS BREVIPENNIS* (LATREILLE) (HETEROPTERA: LYGAEIDAE)

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Abstract.—The Palaearctic lygaeid *Plinthisus brevipennis* (Latreille) is reported from North America for the first time. The status' of three other adventive species in the Pacific Northwest *Stygnocoris rusticus* (Fallen), *Stygnocoris sabulosus* (Schilling), and *Megalonotus sabulicola* (Thomson) are reviewed. Dorsal habitus illustrations and distribution maps are provided for all species.

Key Words.—Insecta, Heteroptera, Lygaeidae, *Stygnocoris, Megalonotus, Plinthisus,* introduced species

The accidental introduction, establishment and dispersal of insects is a dynamic problem of contemporary biogeography (Elton 1958). In a review of insect introductions into North America, Sailer (1983) noted that 66% of all introduced species come from the western Palaearctic; in contrast, the Southern Hemisphere has contributed relatively few (Lattin & Oman 1983). Here we discuss the establishment and spread of four species of ground inhabiting seed bugs (Heteroptera: Lygaeidae) that have been introduced into the Pacific Northwest from the Palaearctic. One of these species, *Plinthisus brevipennis* (Latreille), is reported from North America for the first time.

Abbreviations used for depositories of the material examined are: Oregon State University (OSU); University of British Columbia (UBC); Canadian National Collection (CNC).

PLINTHISUS BREVIPENNIS (LATREILLE)

Morphological Characteristics.—*Male* (Figs. 1–2): relatively large species, total length 2.45–3.00 mm; elongate oval in outline; general coloration dark brown to black; antenna red-brown, distal ends of each segment lighter; rostrum red-yellow, basal segment fuscous; femora red-brown; tibiae and tarsi light red-yellow, ventral surfaces fuscous to black; lateral margin of pronotum occasionally yellow-red. Pronotum quadrate, length 0.82–0.95 mm, width 0.82–1.00 mm, anterior corners of pronotum produced forward, lateral margins weakly sinuate, posterior margin straight or weakly concave; anterior lobe of pronotum smooth, posterior lobe shallowly punctate, dorsal surface almost glabrous, with short, pale, inclined setae; hemelytra (brachypterous form) reaching just anteriad of fourth visible abdominal tergite, dorsal surface with short, pale setae arising from shallow, linearly arranged punctures.

Female.—slightly larger than male, total length 2.98–3.20 mm; pronotum length 0.83–0.93 mm, pronotum width 1.03–1.15 mm; posterior pronotal lobe without punctures.

Diagnosis.—*Plinthisus brevipennis* is easily distinguished from the three native western species by its large size. *Plinthisus longisetosus* Barber, *P. martini* Van

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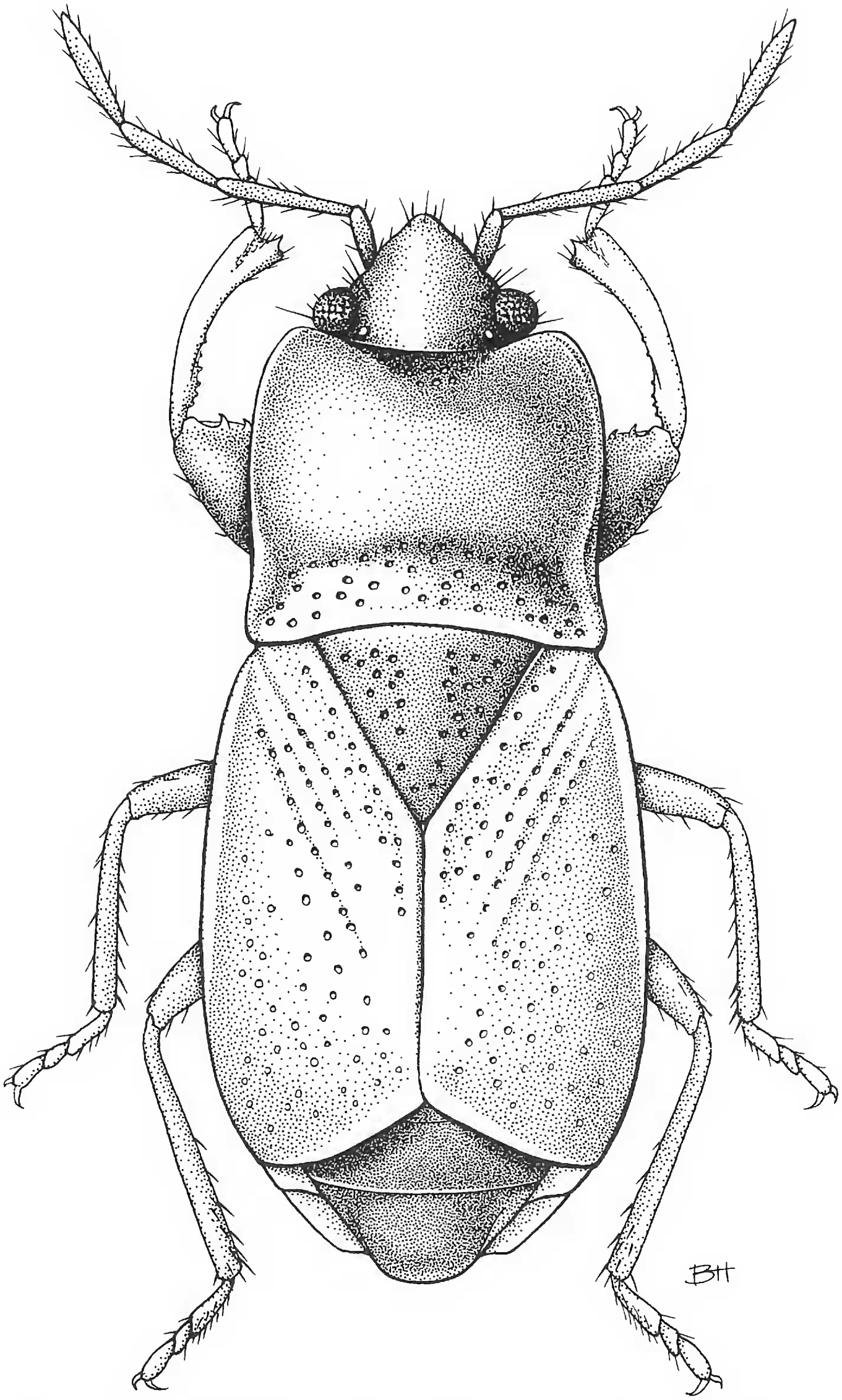

Figure 1. *Plinthisus brevipennis* (Latreille). Dorsal habitus of adult male. Brachypterous form.

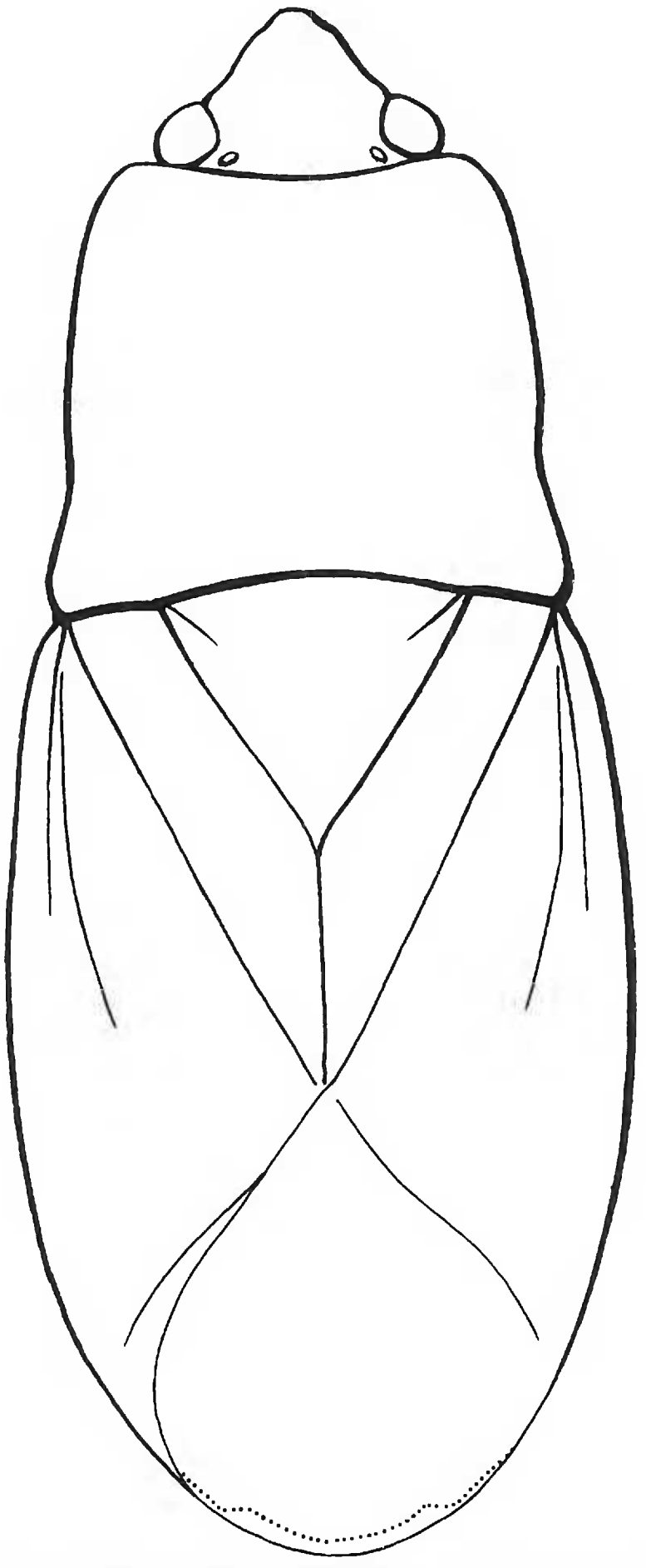

Figure 2. *Plinthisus brevipennis* (Latreille). Dorsal habitus of adult male. Macropterous form.

Duzee, and *P. pallidus* Barber are all less than 2.0 mm total length. In *Plinthisus indentatus* Barber and *P. americanus* Van Duzee the pronotum is much more convex, both transversely and longitudinally, than that of *P. brevipennis*. The two former species and *P. compactus* (Uhler) also have long erect setae on the pronotum and hemelytra, and the posterior lobe of the pronotum is punctate in females. *Plinthisus brevipennis* also has much thicker fore femora. The maximum

width of the fore femur in *brevipennis* is equal to, or greater than, the width of vertex, whereas in native North American *Plinthisus* this measurement is less than the width of the vertex.

Discussion.—*Plinthisus brevipennis* (Latreille) (Latreille 1807) is widely distributed in the western Palaearctic, occurring in England and Norway, throughout Europe, east to the western U.S.S.R., south to Turkestan, Israel and North Africa (Slater 1964). This species inhabits sandy areas, such as littoral sand hills and sand pits in England (Butler 1923), and is often found under dead leaves and at the roots of low plants. Carayon (1949) found it common in the bases of grass clumps on littoral dunes and under heather in pine forests in France.

In June, 1988, a single adult specimen of *P. brevipennis* was collected from roadside vegetation in Benton Co., Oregon. In April, 1989, several individuals were collected from a rodent burrow in moss under matted grass. Additional specimens were extracted from the base of grass clumps collected in two other localities in Benton Co., Oregon. Two specimens were also found in litter samples from a clearcut forest area near Seattle, Washington, in April, 1989. The only other specimen we have seen was also collected near Seattle, Washington, in 1964.

We (JDL) have made extensive collections of ground-inhabiting Heteroptera, with special emphasis on the Lygaeidae, in western Oregon from the late 1950s to the mid-1960s. The map in Fig. 7 shows numerous collecting sites for another introduced lygaeid, *Megalonotus sabulicola* (Thomson) (see below), which reflects this collecting activity. We believe the failure to collect specimens of *P. brevipennis* during that collecting period indicates its absence, at least from the Willamette Valley of Oregon. This suggests that *P. brevipennis* is a relatively recent introduction into the Pacific Northwest, rather than a species that has gone undetected.

In England, *P. brevipennis* overwinters as an adult and oviposition occurs in late May or June with nymphs maturing in late July or early August (Southwood & Leston 1959). Guerin & Peneau (1905) found adults under moss in the winter, and Halbert (1935) reported adults and nymphs collected from moss in July. Brachypterous (Fig. 1) and macropterous (Fig. 2) forms occur in both sexes and Butler (1923) reported that although the macropterous form is usually rare, it occasionally occurs in large numbers. In one collection of 55 individuals from Benton Co., Oregon, we found both male and female macropters, but the brachypterous forms were much more numerous (Male ratio, 22 brachypterous : 3 macropterous; Female ratio, 25 brachypterous : 6 macropterous). Southwood & Leston (1959) stated that macropters fly readily, and we collected one individual by sweeping roadside grasses. The occasional high frequency of macroptery may contribute to its dispersal in the Pacific Northwest.

Plinthisus, containing approximately 75 species worldwide, is currently the only genus in the tribe Plinthisini. It is unique in the Rhyparochrominae in that the intersegmental conjuctivum is present between sterna IV and V of the female (Slater et al. 1962). Based on these unusual characters, including the unique structure of the phallus, it has been suggested as deserving subfamilial status (Putshkov 1958, Sweet 1967). Currently, there are six species described from North America (Ashlock & Slater 1988), *P. americanus* (Van Duzee) from New England, and the others from the western U.S., although there may be several undescribed species from western North America (Sweet 1964b, Ashlock 1977, J. A. Slater, personal communication).

Material Examined.—USA. WASHINGTON. *KING Co.:* Carnation, 14 May 1964, O. Milne (OSU). *MASON Co.:* Matlock, 23 Apr 1989, ex clearcut litter sample, A. Moldenke (OSU). OREGON. *BENTON Co.:* Alsea Falls St Pk, 22 Jun 1988, A. Asquith. Corvallis, 8 Apr 1989, ex moss in grass clump, A. Asquith (OSU); 1.6 km (1 mi) S of Corvallis, 16 Apr 1989, ex grass clump, A. Asquith (OSU); Finley Wildlife Refuge, 16 Apr 1989, ex grass clump, A. Asquith (OSU).

Stygnocoris rusticus (Fallen)

Stygnocoris rusticus (Fallen) (Fig. 3) is a widespread, western Palaearctic species found throughout Europe, the Mediterranean, central Asia, to Sinkiang province of northwestern China (Hsiao et al. 1981). Although the extent of its distribution in northeastern Asia is unclear, it was not reported from eastern Siberia by Kerzhner (1988). Horvath (1908) and Heidemann (1908) both reported *Stygnocoris rusticus* from North America in 1908, with Heidemann's specimens collected in New York. Gibson (1917) recorded it from Truro, Nova Scotia (along with *S. sabulosus* (Schilling) from the same locality) and Van Duzee (1917) reported *S. rusticus* from Quebec. Barber (1918) discussed both species and gave additional records. Downes (1924) recorded *S. rusticus* from Vernon, British Columbia based upon specimens he collected in 1919. Barber (1928) provided data on both *S. rusticus* and *S. sabulosus* from a site in the Adirondacks.

Sweet (1964b, 1967) provided a thorough treatment of the biology and life history of this species, including abdominal morphology, male and female genitalia, egg, hind wing venation, illustration of the fifth instar nymph, as well as a review of earlier records. A detailed bibliography of the species can be found in the catalogue by Slater (1964), and Wheeler (1983) recently reviewed the distribution and history of *S. rusticus* in eastern North America.

Stygnocoris rusticus is a commonly collected lygaeid in British Columbia, but not so in Oregon and Washington, especially when compared with *S. sabulosus* (Schilling) (see below). Downes (1924) reported its capture in 1919 at Vernon, British Columbia and Barber (1948) reported it from Dukabush, Washington (approximately 24 km (15 mi) south of Quilcene, Jefferson Co.) based on specimens collected by the late Herbert Ruckes. Besides these records, we have seen only three additional specimens from the state of Washington: a brachypterous female, a macropterous female and a brachypterous male (see material examined). Southwood & Leston (1959) stated that *S. rusticus* is usually brachypterous, and that it normally overwinters in the egg stage, although some adults may persist until spring.

Its occurrence in the Pacific Northwest is far more restricted than in the eastern U.S. (Fig. 4). This may be because forested mountains, high moisture gradients, and patterns of agricultural development in the west present potential dispersal problems for less vagile species. *Stygnocoris rusticus,* like other introduced species, is probably synanthropic, and may be restricted to relatively disturbed areas. The collection site at Niles Lake in northeastern Washington clearly showed signs of past disturbance; it was apparently an old saw mill and has the remains of concrete foundations.

Material Examined.—CANADA. BRITISH COLUMBIA. Celista, 11 Sep 1954, W. Downes (UBC); Cultus Lake, 2 Sep 1959, G. G. E. Scudder (UBC); Enderby, 22 Aug 1920, W. Downes (UBC); Erickson, 2 Jul 1982, G. G. E. Scudder (UBC); Galiano Isl., Spanish Hills, 31 Aug 1983, G. G. E. Scudder (UBC); Green Timbers, 16 Aug 1938, R. Longmore (UBC); Hope, 28 Aug 1961, G. G. E. Scudder (UBC); Kelowna, 8 Aug 1926, W. Downes (UBC); Langley, 24 Aug 1954, W. Downes (UBC); Merritt,

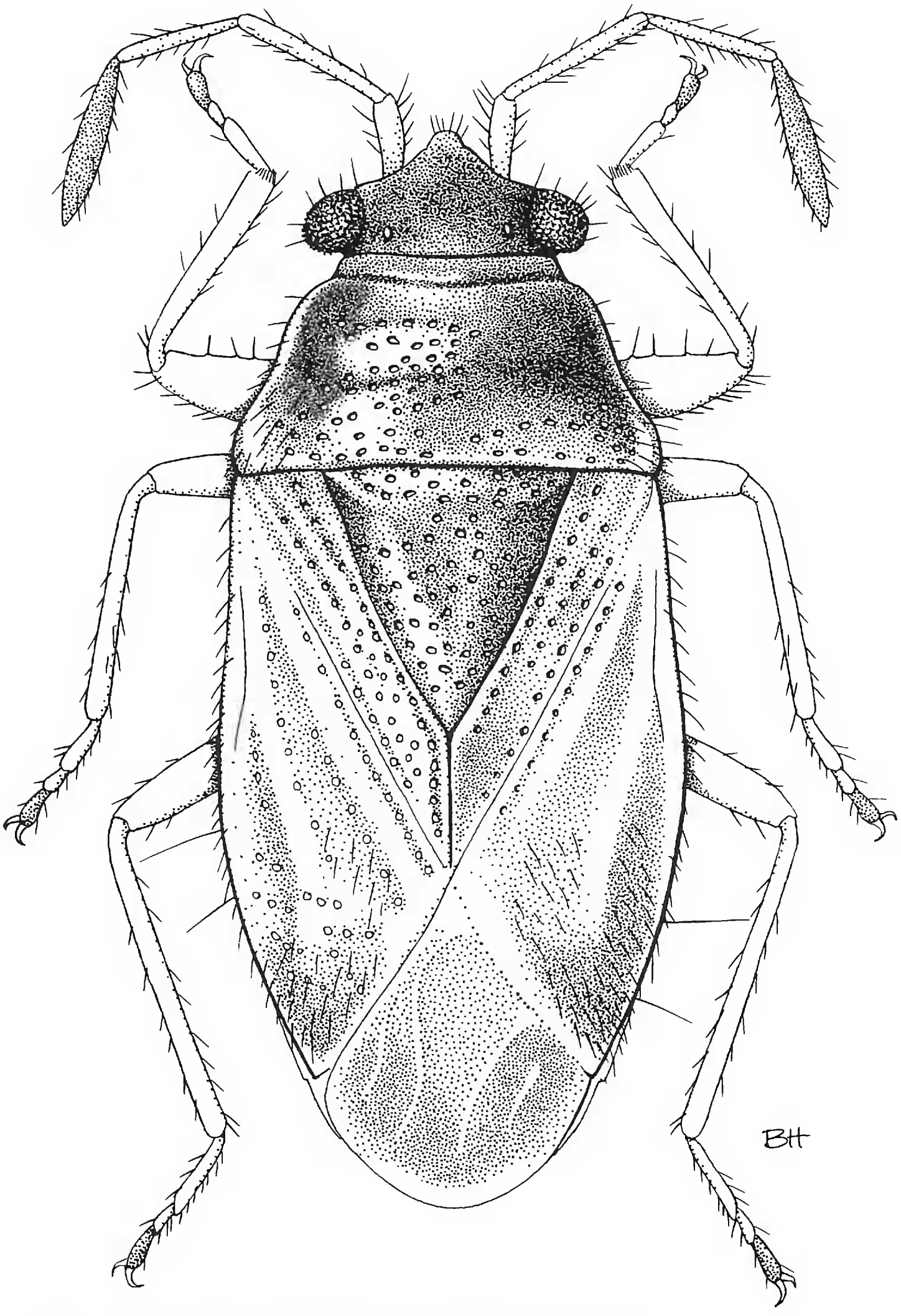

Figure 3. *Stygnocoris rusticus* (Fallen). Dorsal habitus of adult male.

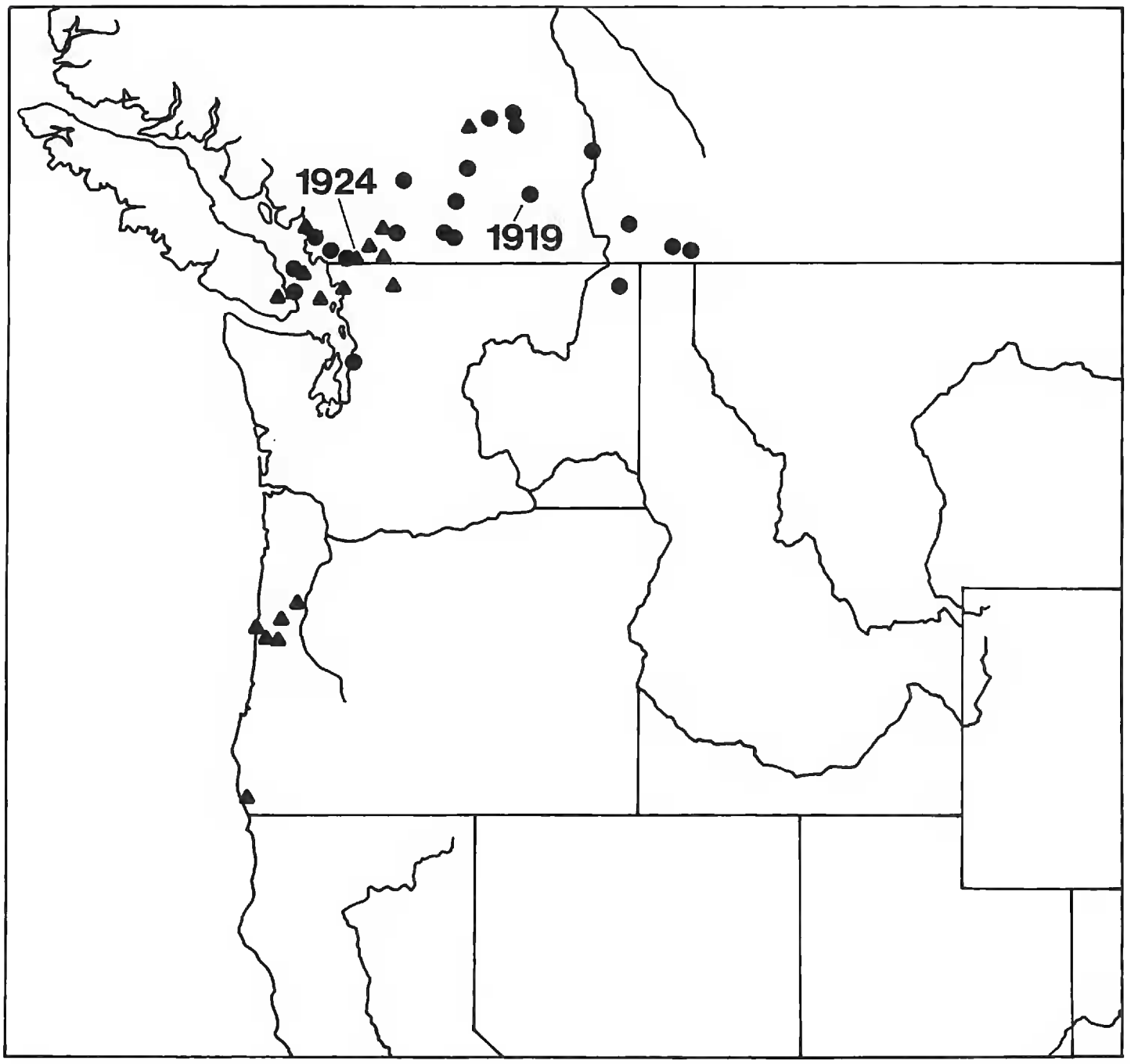

Figure 4. Distributions of *Stygnocoris rusticus* (circles) and *S. sabulosus* (triangles) in western North America.

12 Aug 1948, C. L. Neilson & D. Finlayson (UBC); Nakusp, 25 Aug 1989, G. G. E. Scudder (UBC); Nelson, 26 Aug 1953, M. H. Hatch (OSU). Penticton, 25 Aug 1924, W. Downes (UBC); Royal Oak, 19 Sep 1949, W. Downes (UBC); Saanich, 28 Jul 1954, W. Downes (UBC); Salmon Arm, 6 Oct 1934, H. B. Leech (CNC); Sandspit, Moresby Isl., Queen Charlotte Islands, 25 Aug 1984, G. G. E. Scudder (UBC); Sidney, 31 Aug 1949, W of Downes (UBC); Steelhead, Sep 1933, H. B. Leech (UBC); Summerland, 1 Oct 1932, A. N. Gartrall (CNC); Vancouver, 9 Aug 1929, W. Downes (UBC); Vernon, 22 Sep 1923, D. G. Gillespie (CNC); Yahk, 29 Aug 1989, G. G. E. Scudder (UBC). USA. WASHINGTON. *KING Co.:* Bothell, 20 Jul 1939 (OSU). *PEND ORIELLE Co.:* Niles Lake 1350 m (4500 ft), 9.6 km (6 mi) SW of Tiger, 9 Sep 1958, J. D. Lattin, on ground (OSU).

Stygnocoris sabulosus (Schilling)

Stygnocoris sabulosus (Schilling) (Fig. 5) was first reported from North America by Gibson (1917) [as *Stygnocoris pedestris* (Fallen)], based upon specimens collected in 1923 at Truro, Nova Scotia. Barber (1918) recorded several localities from New York and Cape Breton Island, Nova Scotia, and Barber (1928) provided the numerical data of a collection from New York. It was then reported from Quebec (Moore 1950), Newfoundland (Lindberg 1958), Connecticut, Maine, Massachusetts and New Hampshire (Sweet 1964a, b; Slater 1964).

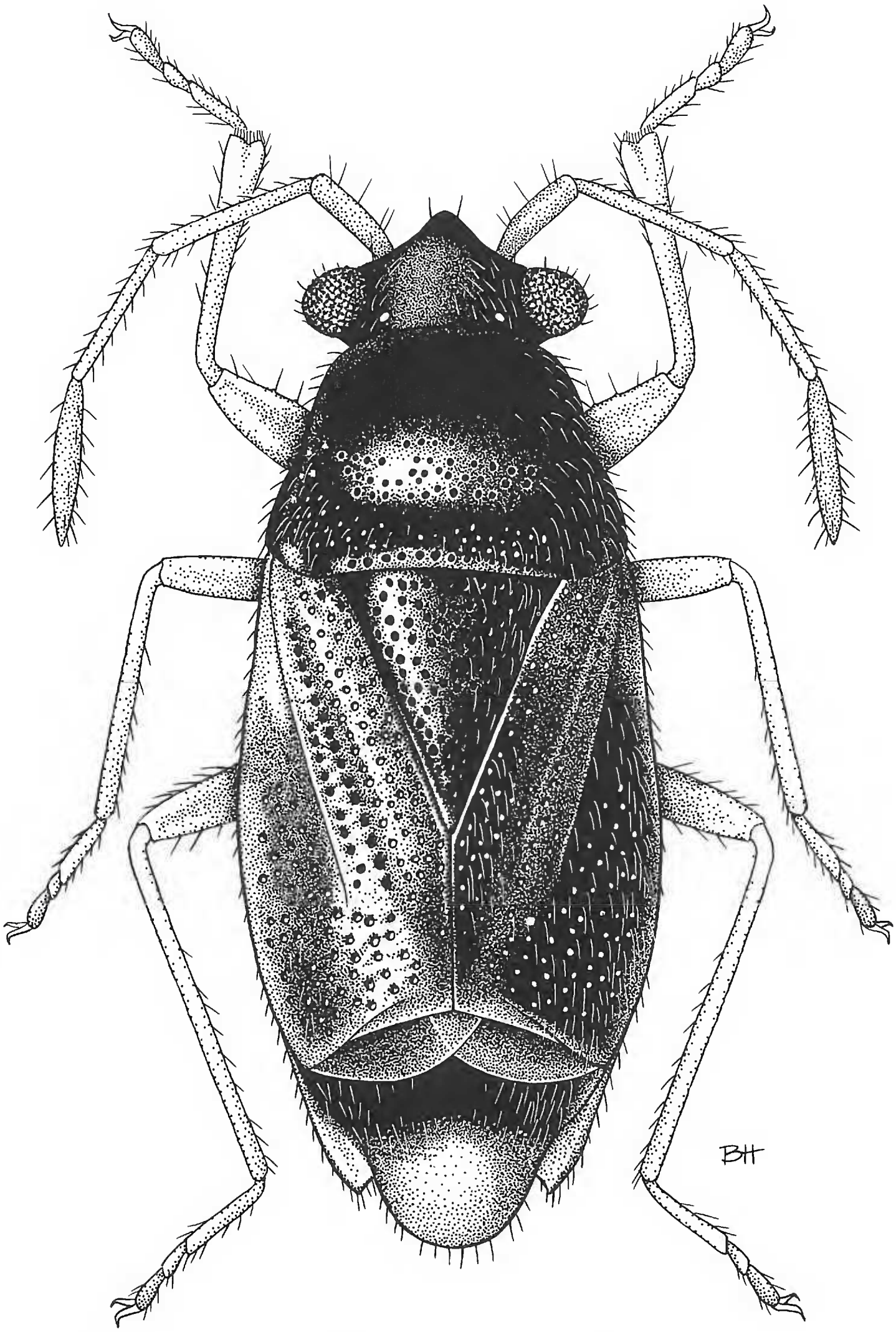

Figure 5. *Stygnocoris sabulosus* (Schilling). Dorsal habitus of adult male.

In 1961, Scudder reported *Stygnocoris sabulosus* [as *S. pedestris*] from British Columbia. The earliest collection in the west dates from 1924, taken at Agassiz, British Columbia. Ashlock & Slater (1988) added an Oregon record but did not include the records of Sweet (1964b). We have examined specimens from southwestern British Columbia and western Washington and Oregon (Fig. 4) with most records either from the coast or the Willamette-Puget lowlands. In Britain, this species is always fully winged (Southwood & Leston 1959), and indeed, all specimens we examined were macropterous. This suggests that this species is probably more vagile than its congener *S. rusticus* (see above).

Material Examined.—CANADA. BRITISH COLUMBIA. Agassiz, 14 Sep 1924, R. Glendenning (CNC); Chilliwack, 14 Oct 1938, J. K. Jacob (CNC); Cultus Lake, 21 Oct 1938, J. K. Jacob (CNC); Cultus Lake, 2 Sep 1959, G. G. E. Scudder (UBC); Galiano Isl, north end, 18 Aug 1982, 11 Oct 1987, G. G. E. Scudder (UBC); Hope, 28 Aug 1961, 20 Sep 1962, G. G. E. Scuddder (UBC); Jack Lake, 1 Sep 1953 (CNC); Kamloops, Lac de Bois, 14 Aug 1988, G. G. E. Scudder (UBC); Lions Bay, Squamish Road, 16 Oct 1960, G. J. Spencer (UBC); Malahat, 20 Sep 1950, W of Downes (UBC); Vancouver Island, Shawnigan Lake, 4.8 km (3 mi) SW of Cobble Hill, gravel pit, 10 Sep 1960, J. D. Lattin coll. (OSU). USA. OREGON. *BENTON Co.:* N Fork, Alsea River, 8 km (5 mi) NE of Alsea, 5 Oct 1970, moss on cedar log, J. D. Lattin (OSU); Corvallis, 10 Sep 1967, in dry sawdust under *Cotoneaster,* J. D. Lattin (OSU); Mary's Peak 22.4 km (14 mi) W of Corvallis, 8 Sep 1971, Summit Meadow campground, 1080 m (3600 ft), J. D. Lattin (OSU); 23 Jul 1977, ex *Corylus,* J. D. Lattin (OSU). *CURRY Co.:* Brookings, 21 Aug 1977, J. D. Lattin, under Sitka spruce (OSU). *LINCOLN Co.:* Canal Creek, 16 km (10 mi) ESE of Waldport, 8–15 Aug 1968, J. D. Lattin (OSU); 3.4 km (2.5 mi) N of Waldport, 23 Jul 1970, P. Oman (OSU). WASHINGTON. *SAN JUAN Co.:* Orcus Island, Crescent Lake, Moran St Pk, 4 Sep 1960, ex grass clumps along lake, J. D. Lattin (OSU). *WHATCOM Co.:* Bellingham, 8 Aug 1976 (OSU); Mt Baker Nat'l For, R9E-T39N-Sec17, 7 Sep 1979, ex *Tsuga mertensiana,* G. M. Stonedahl (OSU).

Megalonotus sabulicola (Thomson)

This species (Fig. 6), known from North America for more than 60 years, was first reported by Van Duzee (1928) when he desribed *Rhyparochromus chiragra* "var. *californicus*." Although much of the literature on this species is cited under *Megalonotus chiragra* (Fabr.), ultimately, the correct name was determined to be *Megalonotus sabulicola* (Thomson) (Scudder 1961, Southwood 1963, Ashlock 1977).

Megalonotus sabulicola is widespread in western Europe, North Africa, the Middle East and the western U.S.S.R. (Slater 1964, Wheeler 1989). Southwood & Leston (1959) provided a brief summary of its habits and Scudder (1961) and Southwood (1963) clarified the status of *M. sabulicola* as a species distinct from *M. chiragra.*

Slater & Sweet (1958) recorded *M. sabulicola* from eastern North America for the first time, based upon specimens they collected in 1957 in Connecticut. Sweet (1964a, b) gave an excellent account of the history, biology and ecology of this species in New England, including a discussion of "a cryptic form" of brachyptery, with only slightly reduced forewings and short hind wings. Wheeler (1989) recently provided information on the present distribution of this species in the eastern U.S. as well as a discussion of habits and host plant preferences including its potential as a biological control for spotted knapweed (*Centaurea maculosa* Lamarck). Williams (1947) recorded *M. sabulicola* as prey for a species of *Diploplectron* (Hymenoptera: Sphecidae) in California.

Scudder (1960, 1961) provided detailed records for British Columbia (earliest

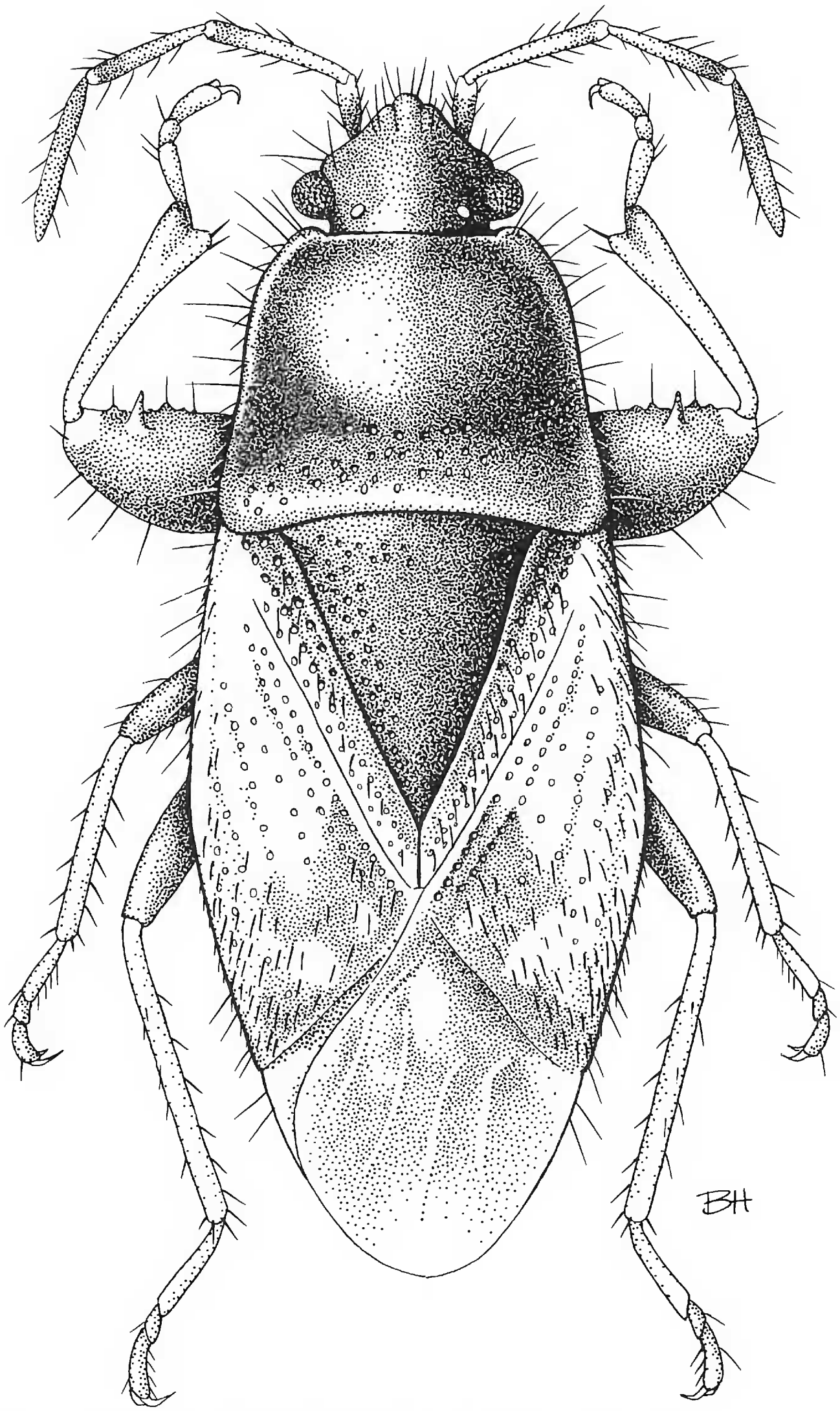

Figure 6. *Megalonotus sabulicola* (Thomas). Dorsal habitus of adult male.

collection record is now West Vancouver, 1926) and included a record for Seattle, Washington (no date). Ashlock (1977) gave a thorough discussion of *M. sabulicola,* emphasizing dispersal and earliest dates of collection in different parts of western North America. He also provided the first records from Idaho and Utah (Ashlock 1977). *Megalonotus sabulicola* is now a rather common species in the Pacific Northwest in disturbed areas and is widespread in western North America, from southern British Columbia to southern California (Fig. 7).

Discussion

The four species discussed above are presently the only members of the Lygaeidae considered adventive in the Pacific Northwest. Although we have attempted to be exhaustive in our review of the pertinent information for these species, numerous questions remain unanswered or are at least equivocal. The distributions of these species are still imperfectly known and extrapolation from historical records is tenuous; therefore, we cannot be certain that they are all truly nonnative. Consider, for example, that *Stygnocoris sabulosus* is predominately western Palaearctic in natural distribution (Slater 1964), thus its records from far eastern U.S.S.R. by Kerzhner (1988) are of special interest. All Siberian records are clustered just north of Vladivostok and on the Kurile Islands. Whether these represent introductions or relictual populations is unclear. This also suggests that *S. sabulosus* is also natural to the Pacific Northwest. The four arguments for its adventive status are: (1) the rather late date of collection (1950); (2) the absence of any other species of Stygnocorini in North America, except the introduced *S. rusticus*; (3) its absence from the area of Eastern Beringia; and (4) its preponderance in disturbed habitats.

The status of some *M. sabulicola* localities is also unclear. One Palaearctic record of considerable interest is that of Kerzhner (1988), where he reported *M. sabulicola* from two regions of far eastern U.S.S.R., the Amur River region and the area immediately north of, and including, Vladivostok. The Amur River region is known for relictual populations, whereas Vladivostok is a busy seaport at about the same latitude as Portland, Oregon. Because there is an enormous discontinuity between these two regions and the European portion of U.S.S.R., it would be interesting to know if the date of collection of the Siberian material is also relatively recent, and whether other synanthropic taxa are known from these localities.

We can only speculate how these ground inhabiting species became established in North America. Sweet (1964b) suggested that *Stygnocoris rusticus* was introduced into North America with discharged ship ballast. Wheeler (1983) felt that the species had been introduced into eastern North America well after the ballast period (Lindroth 1957) and sugested that a more likely mode of introduction was imported nursery stock. The collection of this species in 1919 in the interior of British Columbia by Downes (1924) is particularly interesting and may corroborate the ballast hypothesis in the Pacific Northwest at least. Movement of nursery stock is possible as well, however, because there is a strong representation of the British flora in southern British Columbia.

Although Slater & Sweet (1958) believed that ballast was a possible vehicle for the introduction of *Megalonotus sabulicola* into western North America, they believed that it was more likely to have been introduced into eastern North America by plant introductions. The late discovery of this species in the eastern

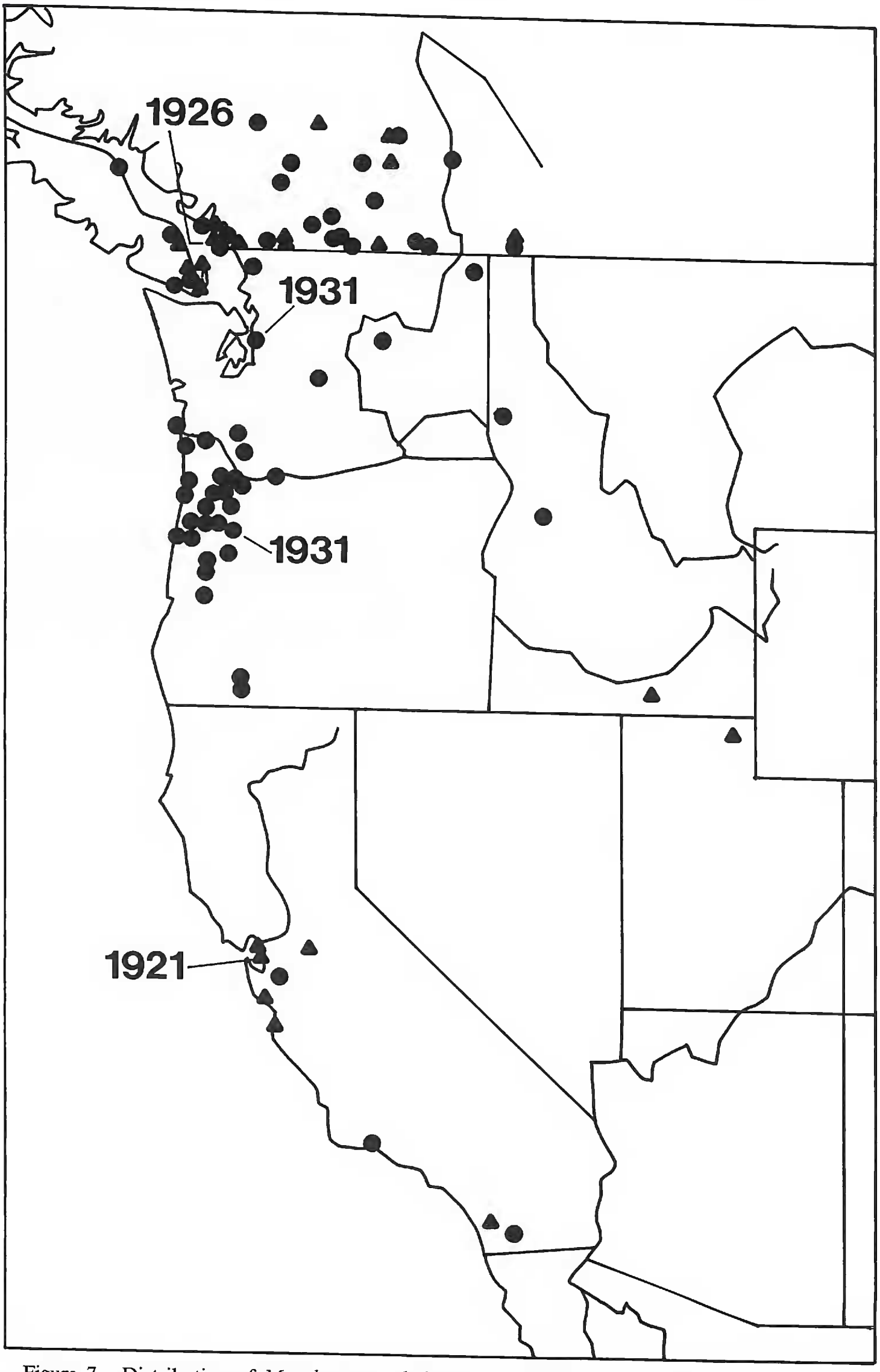

Figure 7. Distribution of *Megalonotus sabulicola* in western North America. Circles represent specimens examined; triangles represent literature records.

U.S. (1957) was probably past the ballast period for the east coast (Sailer 1983). Although the use of ballast continued much longer along the west coast (Lindroth 1957; Scudder 1958, 1960, 1961; Lattin 1966), the very recent discovery of *Plinthisus brevipennis* (earliest collection record is 1964) also suggests a post-ballast entry time.

Comparing the distributions of these species with other groups might also be enlightening. It is interesting, for example, that the localities for *Stygnocoris rusticus* in southeastern British Columbia and northeastern Washington are mirrored by the introduced carabid beetle, *Pristonychus terricola* Herbst. This beetle is known only from Creston, in southeastern British Columbia (Spence & Spence 1988), a locale very close to the collections of *S. rusticus*. Spence & Spence (1988), in their work on the introduced ground beetles of western Canada, considered Creston to be one of the four centers of carabid introduction in British Columbia. More intensive collecting around likely areas of introduction and continued periodic monitoring will increase our understanding of these adventive species and provide the opportunity for more accurate data should future introductions occur.

Acknowledgment

We thank James A. Slater for confirming our identification of *Plinthisus brevipennis* and reviewing the manuscript. Data on specimens in the collections of the University of British Columbia and the Canadian National Collection were kindly provided by G. G. E. Scudder, who also critically reviewed the manuscript. We also thank Bonnie B. Hall for the fine habitus illustrations.

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